COMMITTEE T1
CONTRIBUTION

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STANDARDS PROJECT:

Analog Interface Performance Specifications for Digital Video Teleconferencing/Video Telephony Service (T1Q1-12)

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TITLE: Study Group 12 Activity: Question 22 "Audiovisual Quality in Multimedia Services"-May 1996 meeting

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ISSUE ADDRESSED: Video Quality, Multimedia Quality, Performance

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Summary of Question 22 activity

Below are the highlights of the May 1996 meeting of ITU-T Study Group 12 Question 22. The Q22/12 portion of the meeting report follows.

Approval of 3 ITU-T Recommendations:

- P.910 - **"Subjective video quality assessment methods for multimedia applications"**
- P.920 - **"Interactive test methods for audiovisual communications"**
- P.930 - **"Principles of a Reference Impairment System for Video"**

Splitting of Q22 into two questions:

Subjective methods for evaluating audiovisual quality in multimedia services
Objective methods for evaluating audiovisual quality in multimedia services

Continuing work on P.AVQ (**"Non interactive one-way test methods for overall audiovisual quality evaluation in multimedia applications"**) into the next study period.

Presentation of a contribution on visual channel delay: **Visual channel delay and frame rate measurement - initial results with a prototype system (AT&T).**

Presentation of **Selections from the draft American National Standard: - Digital transport of one-way signals - parameters for objective performance assessment (USA).** It is expected that this will form the kernel of an ITU-T Recommendation which will be approved during the next study period.

Presentation of a contribution showing results using the ANSI objective video quality measures: **A Two-Stage Objective Model For Video Quality Evaluation (Bellcore).**

Presentation of a contribution concerning **The impact of differential delay on video conferencing quality (Bellcore).**

Final Version of Report

Q22/12 - Audiovisual quality in multimedia services (Rapporteurs Mrs. L. Contin, Mr. A. Webster)

1. Introduction

The wording of Q. 22/12 "Audiovisual quality in multimedia services" can be found in COM12-1, page 21. The goal of the Question is the definition of one-way and two-way opinion test methods and objective test methods to evaluate transmission performance of audiovisual systems.

In the framework of the Question, draft Recommendations have been developed and submitted for approval at this meeting. The Recommendations are:

- P.910 - "Subjective video quality assessment methods for multimedia applications"
- P.920 - "Interactive test methods for audiovisual communications"
- P.930 - "Principles of a Reference Impairment System for Video"

The text of the above listed draft Recommendation can be found in COM12-R26.

2. New contributions

Com. 12-75 Visual channel delay and frame rate measurement - initial results with a prototype system (AT&T)

This contribution describes the initial measurements on a video channel using a prototype delay and frame rate measurement system. The method employed here expects and measures the instantaneous delay variations that are frequently present in video conference systems and services today.

Com. 12-66 Selections from the draft American National Standard: - Digital transport of one-way signals - parameters for objective performance assessment (USA)

This document, that includes selections of an ANSI Draft Standard, specifies methods of measurement for video performance parameters for one-way video transmission service channels that employ digital transport. These video performance parameters are defined for the end-to-end transmission quality between the service providers and the end users.

Del D 101 A Two-Stage Objective Model For Video Quality Evaluation (Bellcore)

This contribution describes several measures that might be useful as a basis for comparing the present operational readiness of a video system with the same system's past performance. This contribution provides the results of a study conducted to determine the feasibility of developing a video performance model using the T1A1.5 measures to allow the monitoring of video service performance across time.

Del. D 100 The impact of differential delay on video conferencing quality (Bellcore)

This contribution reports on a study that was conducted to examine the impact of differential delay on video conferencing quality. The results of the study indicate that end user's perception of video conferencing service quality varies both as a function of pure delay and audio/video synchronization.

TD 83 Draft ITU-T Recommendation P.AVQ - Non-interactive test methods for overall audiovisual quality evaluation in multimedia applications (Rapporteurs)

This Recommendation is intended to define non-interactive subjective assessment methods for evaluating the overall quality of digital video with accompanying audio. The first draft of this Recommendation was discussed during the previous meeting. This second draft reflects that

discussion and the development made after that meeting. Further studies are required before starting the approval procedure.

TD 84 Proposed amendments to P.910, P.920 and P. 930 (Rapporteurs)
This document proposes a few editorial changes to be applied to the Annex of draft P.930.

TD 81 Progress report of the JCG-AVMMS (Rapporteurs)
JCG-AVMMS activities were continued by correspondence and a contribution for the last TSAG meeting was produced. This documents includes this contribution and an excerpt of the TSAG WP2 meeting report.

TD 82 Liaison statement from WP11E
This liaison deals with the standardization activities of ITU-R WP11E on subjective video quality assessment.

TD 85 Draft of New Question for Study Group 12 - Audiovisual Quality in Multimedia Services - Objective measurement methods (Rapporteurs)
New Question on Objective quality measures is proposed. It was formerly part of 22/12. Close interaction is advisable between the two questions.

TD 80 Revised text of Question 22/12 - Audiovisual Quality in Multimedia Services - Subjective assessment methods (Rapporteurs)
The previous text of Q.22/12 has been reworded, taking into account both the results achieved by the Question and the needs of users and providers of multimedia services.

3. Discussion

The discussion was mainly focused on the following two points:
1. work items for the next study period
2. possible collaboration with ITU-R WP11E.

Concerning the first point, the Rapporteurs suggested splitting Q.22/12 in two questions, one dealing with subjective assessment methods, the other dealing with objective measurement methods.

The first Question will initially concentrate on revising P.910, P.920 and P.930, finalizing a new recommendation on non-interactive test methods for overall assessment of audiovisual quality (i.e. "P.AVQ-Non interactive one-way test methods for overall audiovisual quality evaluation in multimedia applications") and developing new task-oriented/application-dependent evaluation methods for assessing the performance of audiovisual systems in real-life situations. Work will also begin on the assessment of multimedia systems including CD-ROM based and interactive applications.

The main goal of the second Question is to develop recommendations covering objective methods for video and audiovisual quality evaluation.

Mr. Coverdale expressed some reservations about splitting the Question into two. The Rapporteurs explained that the main reason for splitting the question was to streamline the work. In any case the work in the two questions will be closely linked and it is suggested that they remain in the same working party.

An ad hoc meeting for Q.22/12 was held on Tuesday, May 7 to discuss the workplan for the next study period and to revise the draft texts of the two new Questions related to audiovisual quality in multimedia services (Annexes 1 and 2).

The liaison statement from ITU-R WP11E was read and discussed. It was decided that we will reply with a liaison encouraging collaboration between WP11E and Study Group 12 WP2 (Annex 3).

4. List of documents

New documents

COM. 12-66 Selections from the draft American National Standard: - Digital transport of one-way signals - parameters for objective performance assessment (USA)
COM. 12-75 Visual channel delay and frame rate measurement - initial results with a prototype system (AT&T)
Del D 101 A Two-Stage Objective Model For Video Quality Evaluation (Bellcore)
Del. D 100 The impact of differential delay on video conferencing quality (Bellcore)

TD 83 Draft ITU-T Recommendation P.AVQ - Subjective assessment methods for global audiovisual quality (Rapporteurs)
TD 84 Proposed amendments to P.910, P.920 and P. 930 (Rapporteurs)
TD 81 Progress report of the JCG-AVMMS (Rapporteurs)
TD 82 Liaison statement from WP11E
TD 85 Draft of New Question for Study Group 12 - Audiovisual Quality in Multimedia Services - Objective measurement methods (Rapporteurs)
TD 80 Revised text of Question 22/12 - Audiovisual Quality in Multimedia Services - Subjective assessment methods (Rapporteurs)

Previous documents

COM. 12-34 Development of the Video Performance Reference Model (USA)
COM. 12-35 Modification of Video Reference Impairment System (VIRIS) to improve edge busyness Impairment simulation (Bellcore)
COM. 12-36 Preliminary work to include jerky motion impairment in VIRIS1 (Bellcore)
COM. 12-37 Extension of Combined Audio/Video Quality Model (Bellcore)
D. 40 Utility of video reference signals based on additive random noise process (NTT)
D. 41 Additional Glossary/Definition Items for Video Performance Studies (USA)
D. 37 Proposal for a new question on transmission performance in ATM networks (Canada)
COM. 12-21 VIRIS, An Experimental Video Reference Impairment System (Bellcore)
COM. 12-20 Experimental Combined Audio/Video Subjective Test Method (Bellcore)
D. 15 Tasks for use in assessment of audiovisual connections (Canada: BNR)
D. 22 Proposed Attributes of a Video Reference Unit (VRU) and the Need for a Standardized Set of Video Test Scenes (USA)
D. 10 Proposal for the activities related to the Question (CSELT-Italy)
D. 11 Assessment of audiovisual terminal performance in the presence of transmission delay (Comsat)
COM. 12-53 Addition of motion correlated impairment artifacts to VIRIS (Bellcore)
COM. 12-54 Combined A/V model with multiples audio and video impairments (Bellcore)
COM. 12-51 ANSI T1 Terms and Definitions for Video Performance Studies (USA)
D. 76 Comparison of three subjective video quality assessment methods (Royal PTT, The Netherlands)

Annex 1
(to reply to Question 22/12)

Proposed new wording of Question 22/12

Title
Subjective methods for evaluating audiovisual quality in multimedia services
Type of Question

Task-oriented , leading to new ITU-T Recommendations.
Background

Digital networks (e.g. ISDN, B-ISDN, ATM, DECT and others) enable communications systems to carry new multimedia services (e.g. audio plus moving or still pictures, audio plus text, etc.). In these digital systems the quality of each communication medium is influenced by a number of interacting factors, such as source coding and compression, bit rate (fixed or variable), delay, bandwidth, synchronization between the media, and many others.

The perceived quality also depends on the kind of application and on the tasks the applications are used for. For example in a free conversation through a videophone the perceived quality primarily depends on delay, lip-synchronization and audio quality, while in a mainly one-way application like remote-teaching the perceived quality could be primarily related to the quality of graph and low motion picture sequences.

Therefore different assessment criteria and procedures should be defined and applied.

During this study period, Q.22/12 started to fill in the gap existing in SG12 between the expertise in audio and video quality evaluation and developed the basic background needed to evaluate multimedia services. Q.22/12 developed three draft Recommendations, two of them (P.910 and P.930) are related to video quality assessment only while the third Recommendation (P.920) is addressed also to joint audio and video evaluation.

Since the above mentioned Recommendations reflect the current early status of research on their respective fields, as new knowledge is attained the Recommendations may have to be revised.

Summarizing, quality evaluation in multimedia services requires on the one hand the continuous updating of draft Recommendations P.910, P.920 and P.930 and on the other hand the definition of new task-oriented/application-dependent evaluation methods for the combined evaluation of audio and video signals.

Objective assessment methods of audiovisual systems will be developed in the framework of another Question.

The work of Q.22/12 and the Question on objective measurements will be closely linked.
Text of the Question

1. What subjective measurement methods should be used to evaluate transmission quality of each medium (e.g. video, audio) and the interactions between the media, with particular attention to the audiovisual quality assessment of coder-decoders for real-time applications and retrieval applications?

2. What specification of reference impairment systems most effectively provide calibrated video and audio impairments for use in subjective tests?

3. What are the most significant physical factors (e.g. temporal resolution, spatial resolution, color, audio and visual artifacts, media synchronization, delay, etc.) affecting the perceived overall quality of multimedia services?

4. Can these factors (as found in 3 above) depend on the kind of application considered?

5. How can the mutual interaction between these factors (as found in 3 above) be subjectively measured with respect to their influence on overall audiovisual quality?

6. For what applications can the subjective measures (as found in 3 above) be shown to be useful and robust over a range of conditions.

7. What are the minimum acceptable quality levels for the physical factors found in 3 above for different applications taking into account the interactions between media?

8. What new methods and assessment tools are required to fully describe the performance of specific multimedia applications (e.g. multipoint conference, remote monitoring, mobile audiovisual communication, etc.)

9. Which audiovisual test material (e.g. audiovisual test sequences) can be used for subjective evaluations?

10. Which criteria should be used to characterize and classify audiovisual test material?

Objectives and schedule

A stable draft of a Recommendation on one-way audiovisual quality test methods is expected to be available in 1998.

Relationship with other Study Groups

This work will most likely be of interest to ITU-T Study Groups 1, 2,8,9,13,14,15 and ITU-R Study Groups 10 and 11.

Annex 2
(to reply to Question 22/12)

Proposed new Question

Title

Objective methods for evaluating audiovisual quality in multimedia services (currently part of Question 22/12)

Type of Question

Task-oriented, leading to new ITU-T Recommendations.

Background

In digital systems the quality of each communication medium is influenced by a number of interacting factors, such as source coding and compression, bit rate (fixed or variable), delay, bandwidth, synchronization between the media, and many others. In the last study period Q22/12 covered both subjective and objective assessment of quality in multimedia services. However, this work has concentrated on subjective methods.

It is felt that the work of Question 22/12 should be divided into two questions, one which covers subjective methods and one which covers objective methods. The work of these two questions will, of course, be closely linked.

The lack of effective measuring methodology based on objective measuring techniques is limiting the degree to which audio and video quality objectives can be expressed in the audiovisual service descriptions being developed in other ITU Study Groups and elsewhere. It is therefore desirable to identify objective techniques for measuring the various individual and combined effects on the perceived quality of audiovisual systems to factors such as digital compression, transmission, storage, and others. It is also important to verify that these techniques are meaningful by correlating proposed objective tests with corresponding subjective test data.

The development of Recommendations for the quality assessment of stand-alone audio is not included in this new audiovisual Question to avoid overlapping work. The Recommendations developed under other study Questions pertaining to this matter will be utilized in the work of this new Question.

Text of the Question

1. What objective measurement methods should be used to evaluate end-to-end quality of each medium (e.g. video, audio) and the interactions between the media, with particular attention to the audiovisual quality assessment of systems used for videoconferencing/videotelephony and other multimedia services?
2. Among the most significant factors (e.g. spatial resolution, temporal resolution, color fidelity, audio and visual artifacts, media synchronization, delay, etc.) affecting the overall quality of multimedia services what objective methods assess the extent of and/or can differentiate between these factors?
3. How can the mutual interaction between these factors (as found in 2 above) be objectively measured with respect to their influence on overall audiovisual quality?
4. For what applications can the objective measures (as found in 2 above) be shown to be useful and robust over a range of conditions.
5. What are the quality levels that can be defined by objective methods for these factors in different applications (or tasks) taking into account the interactions between media?

6. What objective measurements can be used to characterize the quality effects of Multipoint Conference Units for audiovisual communication?
7. What objective methods and assessment tools are required to fully describe perceived audiovisual impairments in terms of measurable system parameters?
8. In some cases it may be useful to combine objective measures (e.g. transmitted frame rate, spatial resolution, audio measures, media synchronization) to provide a single figure of merit. In this regard, which objective measures and/or techniques should be combined, and in what manner, so that the figure of merit correlates satisfactorily with subjective test results?

Objectives and schedule

The first draft of a Recommendation covering the framework for the objective assessment of video quality is expected to be available in 1997. The first draft of a Recommendation on the objective assessment of audiovisual quality is expected in 1998.

Relationship with other Study Groups

This work will most likely be of interest to ITU-T Study Groups 1,2,8,9,13,14 and 15 and ITU-R Study Groups 10 and 11.

Annex 3
(to reply to Question 22/12)

Proposed text for liaison to ITU-R WP 11E

Question: 22/12

Source: Study Group 12
Title: LIAISON TO ITU-R WP 11E ON THE QUALITY ASSESSMENT OF AUDIOVISUAL MULTIMEDIA SERVICES (for information)

Study Group 12 of the ITU-T wishes to thank Working Party ITU-R 11E for their liaison statement. We hold the work of WP 11E in high regard and make reference to ITU-R BT-500 in our draft Recommendation P.910. We are also pleased to use several ITU-R video test sequences in our library of test material. Wherever possible it is our intention to utilize existing ITU Recommendations to avoid overlapping work. However, there are areas of study in which we must break new ground. The quality assessment (subjective and objective) of audiovisual multimedia services is one such area. We invite collaboration with WP 11E and hope that timely liaison activities can result in more efficient standardization procedures.

We have three draft Recommendations pertaining to quality assessment of audiovisual multimedia services that have just been approved by SG12:

P.910 Subjective video quality assessment methods for multimedia applications
P.920 Interactive test methods for audiovisual communications
P.930 Principles of a reference impairment system for video

Our work has benefited from the products of WP 11E and we hope that WP 11E can also benefit from the work and expertise of Study Group 12.

For your information, please find annexed the text of two study Questions proposed for the next study period.

Annexes: 2